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# **Flight Attendant Fatigue, Part V: A Comparative Study of International Flight Attendant Fatigue Regulations and Collective Bargaining Agreements**

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16. Abstract In 2008, Congress directed the Civil Aerospace Medical Institute (CAMI) to conduct follow-on studies of six recommendation areas noted in an integrated report by the National Aeronautics and Space Administration (NASA) and CAMI regarding flight attendant fatigue. The report concluded that some degree of fatigue-related performance affects were likely under current prescriptive rules. Internationally, fatigue risk is managed almost solely through prescriptive rules based on the maximum hours of work and minimum hours of rest. Traditional prescriptive rules, however, have limited applications to round-the-clock operations, often excluding fatigue-contributing factors such as time zone transitions, layover and recovery, time of day, and circadian rhythms (Cabon et al, 2009). Prescriptive rules directly affect crew scheduling and are critical to operator viability; however, due to economic recession, operators are routinely scheduling up to the regulation limits, which could result in an increased likelihood of fatigue and fatigue-related mishaps (Nesthus, Schroeder, Connors, et al., 2007). In the present study, we obtained regulations (n=38) and collective bargaining agreements (CBA) (n=13) regarding flight attendant duty time and rest from International Civil Aviation Organization (ICAO) member states using several resources: Civil Aviation Authority Web sites, an international cabin safety symposium, Web-based ICAO information exchange, and FAA international field offices and aviation safety inspectors. We analyzed each regulation and CBA to identify duty time and rest rules related to working hour limits, sleep and rest requirements, circadian rhythms, and other factors. When comparing the United States (U.S.) maximum hours of work and minimum hours of rest with other countries, we concluded that U.S. prescriptive rules are among the least restrictive, representing a greater than typical risk for fatigue related incidents. We recommend the U.S. establish a sanctioned fatigue workgroup of subject matter experts, aviation stakeholders, medical and research scientists, and aviation Safety Management System experts to evaluate current regulations and develop an adaptive fatigue mitigation safety system combining scientific principles and knowledge with operational support.					
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# FLIGHT ATTENDANT FATIGUE, PART V: A COMPARATIVE STUDY OF INTERNATIONAL FLIGHT ATTENDANT FATIGUE REGULATIONS AND COLLECTIVE BARGAINING AGREEMENTS

## BACKGROUND

While a great deal of research has been conducted on human circadian processes as applied to scheduling and training of flight crews, relatively little research has been accomplished among flight attendants. Performance of cabin duties is critical to safety and security and the literature suggests that all human performance is vulnerable to sleep loss and daily variations in physiological processes tied to underlying biological body-clock mechanisms. The extent of sleep loss, fatigue, and their impact upon performance of duties among the cabin crew population and within the current duty regulations are unknown but are under investigation along with several other congressionally directed research projects with which this report is associated.

In 2005, Congress directed the Civil Aerospace Medical Institute (CAMI) to address issues regarding flight attendant fatigue. CAMI contracted with the National Aeronautics and Space Administration (NASA) Ames Research Center's Fatigue Countermeasures Group to conduct literature and incident report reviews and examine a range of typical flight attendant schedules to assess potential vulnerability to fatigue. NASA delivered two reports that were integrated and published as a Federal Aviation Administration (FAA) Office of Aerospace Medicine Technical Report (Nesthus et al., 2007). In this report, NASA concluded that some degree of fatigue-related performance affects were likely under the current regulations and suggested six areas of research that would facilitate understanding and government-industry decision making. The six recommendations included:

- A survey of field operations.
- Field research on the effects of fatigue.

- A validation of models for assessing flight attendant fatigue.
- A focused study of incident reports.
- A review of international policies and practices.
- The potential benefits of training.

In 2008, Congress provided another directive for CAMI to conduct follow-on studies of the six recommendation areas noted in the 2007 report. To accomplish this directive, CAMI researchers developed a project plan for completing each recommendation. To facilitate support for these projects and ensure participation, CAMI researchers coordinated with representatives of vested organizations (e.g., Air Transport Association, Regional Airline Association, Coalition of Flight Attendants Association of Flight Attendants, Association of Professional Flight Attendants, Transportation Workers Union, International Association Machinists, United Steel Workers, Delta Air Lines, and non-unionized airlines) and provided them with the opportunity to review and comment on aspects of the project plan.

## INTRODUCTION

The National Transportation Safety Board (NTSB) recommended that the Federal Aviation Administration (FAA) reduce accidents/incidents caused by human fatigue by setting working hour limits based on fatigue research, circadian rhythm, and sleep and rest requirements (NTSB, 2008). The FAA currently manages flight attendant working hours and rest requirements through prescriptive rules and allows airlines to schedule duty and rest within the guidelines found under Title 14 Code of Federal Regulation (CFR) sections 121.467 and 135.273 (see Table 1). Before 1994 there were no duty limitations

Table 1. *Summarized Flight Attendant (FA) Rest Periods According to Title 14 CFR*

Scheduled Duty Period (Hr)	Normal Minimum Rest Period (Hr)	Reduced Rest Period (Hr)	Subsequent Rest Period (Hr)	Number of FAs Required
14 or less	9	8	10	Minimum
14-16	12	10	14	Minimum + 1
16-18	12	10	14	Minimum + 2
*18-20	12	10	14	Minimum + 3

\*Applies only to duty periods with 1 or more flights that land or take off outside the 48 contiguous states and the District of Columbia

Note: Generally, off-duty time begins no less than 15 min after the aircraft pulls into the gate and continues until 1 hr prior to a flight attendant's next departure.

or rest requirements for cabin crewmembers in the United States (Kirkland, 2008).

For most aviation authorities around the world, fatigue risk is managed almost solely through prescriptive limits on the maximum duration of work periods and minimum duration of rest periods (Signal, Ratieta, & Gander, 2008). Some advantages to using prescriptive rules to manage fatigue include an equitable industry for economic competition among airlines, they establish a gauge to either achieve or exceed, and they are easy to apply and work well for daytime operations. However, the disadvantage is they are limited in scope, and most were developed without incorporating important human factors elements that affect fatigue such as time zone transitions, layover and recovery, time of day, and circadian rhythms (i.e., physiological functions, such as body temperature, hormone secretion, sleepiness, wakefulness, and alertness variations within a cycle of approximately 24 hr). For example, due to circadian rhythms, a rest break will not have the same benefits across the day, because *when* the break occurs may be more important than the *amount of time* scheduled for the break. Therefore, prescriptive rules based on time limitations are unable to account for all the complexity and interactions of factors that are linked to the hours of scheduled work (Caban et al., 2009).

#### *Risky Business: Pilot vs. Flight Attendant's Fatigue*

The general public is well aware of the catastrophic events that can result when aviation personnel work while fatigued. For example, federal investigators have uncovered evidence that pilot fatigue might have been a factor in the crash of Continental Connection flight 3407 on Feb. 12, 2009 near Buffalo, New York, in which all 49 people onboard and one person on the ground were killed when the plane stalled during icing conditions and plunged into a house. Human fatigue is a serious threat to aviation safety, and many airline passengers would feel uncomfortable boarding a commercial flight knowing the pilot in command was suffering from fatigue. However, would the same hold true if they knew the flight attendants were suffering from fatigue?

#### *Misconception Problem*

Misconceptions and/or lack of knowledge about the duties of flight attendants have contributed to the perception that their sole purpose is to provide customer service. Unfortunately, only during the time of an in-flight emergency do some realize and appreciate the important role of certified flight attendants and their performance of critical safety functions (e.g., performing emergency assistance by fighting fires, administering first aid, leading evacuations, conducting security checks). For instance, in the ditching of US Airways

flight 1549, the flight attendants' professionalism and expert emergency assistance was critical to successfully evacuating 150 passengers from the plane floating in the Hudson River once the flight crew successfully ditched the aircraft. However, if flight attendants are unable to assist passengers during times of emergency, the loss of life or injury could increase dramatically. In the case of Singapore Airlines Flight 006, 31 October 2000, in which 83 of the 179 occupants perished, an eyewitness and survivor of the crash reported, "...that in the crucial minutes after the crash, panicked flight attendants stood frozen and wouldn't show passengers how to unlock the escape hatches." (Perrir, 2000, p.16).

Flight attendants have vigorously fought to change the misconception that their safety function is secondary to customer service. To protect the flying public and themselves, they have lobbied Congress to take a serious look at fatigue-imposing schedules and reduced rest.

The purpose of the current study is to review the regulations, policies, and practices that have been used to manage fatigue internationally. This report provides specific details associated with an extensive review and evaluation of international policies and practices and will be incorporated into CAMI's consolidated report to Congress.

## **METHODS**

#### *Sample Development*

We collected a final sample of 38 regulations and 13 CBAs within and outside of the United States by using several means: 1) Reviewing the Web sites of 117 ICAO member states; 2) Contacting FAA International Field Offices; 3) Attending an International Cabin Safety Symposium; 4) Posting an ICAO Flight Safety Exchange Information announcement; and 5) Contacting FAA Cabin Safety Aviation Safety Inspectors (ASI).

*ICAO Web site.* The majority of the regulations (n=33) were obtained through the ICAO (considered the global forum for civil aviation) Web site link to the member states CAA Web sites. In June 2008, we began our Internet search by reviewing 117 ICAO member's Web sites for regulations and policies addressing flight attendant flight and duty period (FDP) limitations and rest requirements, and we commenced evaluation in April 2009. If we could not locate the regulation or policy on the Web site, we contacted the CAA representative in flight operations or aviation regulations and directives. CAA representatives advised us that some member states did not have regulations governing flight attendant duty time and rest or they had a CBA (written contract negotiated directly between the flight attendants' union and the operator) or a FRMS in development. The CAA

representatives of Transport Canada, New Zealand, and Australia provided a CBA or provided information to obtain a copy of the CBA.

We used the following key words during our Internet search: cabin operations, cabin crew, cabin attendant, crew safety, duty, rest, limitations, safety, rest period, operations, flight crew, flight time limitation (FTL), fatigue, and flight duty period (FDP). We documented each ICAO member's Web site noting the following: 1) Web address of the CAA; 2) Whether or not the CAA Web site had an English translation; 3) Web address where the regulation was located; 4) Whether or not the Web site was functional; and 5) Contact Email address for the CAA.

*FAA International Offices.* We received regulations from Brazil (English translation), Dubai United Arab Emirates, and the Philippines after contacting the FAA directors of three International Field Offices in Brussels, Singapore, and Washington D.C.

*International Cabin Safety Symposium.* CAMI sent one project researcher to the Annual International Aircraft Cabin Safety Symposium held in Montreal, Quebec, Canada from 11-14 February 2008. Attendees from the aviation authorities of India and Colombia submitted their duty time and rest requirement regulations during a scheduled workshop titled "Global Harmonization and You."

*ICAO Flight Safety Exchange Information Announcement.* We posted an announcement on the ICAO Flight Safety Exchange Information Web site to notify ICAO CAA member states about the flight attendant fatigue study and solicited their most current English-translated regulations or policies governing flight attendant fatigue. This resource yielded one inquiry and one suggestion to contact FAA International Field Office directors to approach and solicit foreign civil aviation authorities for regulations and policies.

*FAA Cabin Safety Aviation Safety Inspectors (ASI).* While the CAA representative provided information on getting CBA from Transport Canada, New Zealand, and Australia, the FAA cabin safety ASIs proved to be a valuable resource in obtaining five CBAs from U.S. airlines American, Delta, Frontier, Lynx, and Northwest.

#### *Inclusion Criteria*

When reviewing all of the available regulations, some gave clear definitions of cabin and flight crewmembers while others were ambiguous as to whether the duty time and rest rules applied to all crew members or a select group. We used regulations and CBAs with duty time and rest rules applicable to cabin crewmembers, all crew members, and flight crewmembers—provided the cabin crew was included in the definition for flight crew.

For example, if the flight crew definition excluded cabin crewmembers (i.e., only flight crewmembers assigned to act as pilot, flight engineer, or navigator of an aircraft during flight time) we did not include the duty time and rest regulations in the analyses.

Of the 117 Web sites visited, 38 regulations and 13 CBAs met the criteria for inclusion.

Most CAA Web sites had English translations or partial English translations (n= 82), which enabled us to search for their regulations, usually located in the operations or regulation section.

#### *Content Analysis*

We analyzed the text in each regulation and CBA and developed a list of duty time and rest rules (n=35) used to manage fatigue. Definitions for the most commonly used rules were summarized using their international similarities (see Table 2). Each rule was classified into one of four categories (using the NTSB recommendations) to reduce aviation accidents/incidents caused by human fatigue: 1) working hour limits; 2) sleep and rest requirements; 3) circadian rhythms; and 4) others. The "others" category was added for rules that could not be clearly classified into one of the preceding categories (e.g., commander's discretion; see Table 3). Given the complexity associated with the regulations and CBAs, three raters reviewed a subsample of the documents to ensure that the classifications of duty time and rest rules were made correctly. An analysis of interrater classifications indicated 90% agreement overall.

## **RESULTS**

We analyzed the regulations (n=38) and CBAs (n=13) that met the criteria for inclusion in the study and identified duty time and rest rules (n=35) used to manage fatigue associated with the four categories: working hour limits, sleep and rest requirements, circadian rhythms, and other. We also included a summary of our communications with CAA representatives that indicated they had a FRMS in development in conjunction with or as an alternative to duty time and rest rules.

Table 3 provides a summary of the percentages and number of duty time and rest rules per category used in each regulation and CBA. The majority (49%) of duty times and rest rules were associated with working hour limitations, 37% associated with sleep and rest requirements, 6% circadian rhythm, and 8% other. Table 4 summarizes the number of duty time and rest rules in a regulation or CBA by member state or operator (n=51). Bosnia and Herzegovina regulations provided the most rules associated with working-hour limitations (n=11), while Northwest Airlines and Freedom Air Ltd (n=8) represented the most

Table 2. *Definition of duty time and rest rules used in regulations and CBA*

	Terms	Definition
1	Flight and Duty Time Period (FDP)	The time between reporting for an assignment and release from that assignment. A continuous period of duty in which a flight attendant carries out any task associated with the business of an aircraft operator/certificate holder.
2	Flight Time Limitation (FTL) Period	A continuous period of duty commencing when the aircraft begins a flight segment, moving on its own, and finishes after the aircraft comes to a stop after a flight segment.
3	Minimum Rest	A continuous period of time during which the flight attendant is free from all restraint by a certificate holder.
4	Reduced Rest Period	A continuous period of time during which the flight attendant is free from all restraint by a certificate holder reduced to the maximum limitation due to unforeseen circumstances.
5	Compensatory Rest	Recovery rest given to make-up for a reduced rest period.
6	Day Off	A period of at least 24 hr available for leisure and relaxation free from all duties.
7	Crew Rest Facilities	A hotel room or in case of crew rest onboard aircraft; a chair or bunk separated from passengers.
8	On Duty Rest Break	Usually given on a long flight of 6 hr or more.
9	Positioning/ Deadheading	The time spent traveling from one point to the next on the aircraft operator/certificate holder's time.
10	Late Finished or Early Starts	Late Finish: Duty finishes between 0100 and 0159 local time. Early Start: Duty commences between 0500 and 0659 local time.
11	Time Zone Readjustment	Given more time to rest to adjust to or recover from a time zone different from local time.
12	Duration of Prone Rest (Sleep)	Rest lying down. Does not mean sleep unless it states in regulation.
13	Standby/Reserve Duty	An aircraft operator/certificate holder places restraints on a flight attendant who would be off-duty. The flight attendant is subject for assignment to duty and must be ready for duty.
14	Commander's/ Captain's discretion	The pilot in command may exceed the FDP or reduce the rest time in certain circumstances.
15	Fatigue Responsibility	To whom the responsibility lies to guard against fatigue. An individual may refuse to work if fatigued.
16	Long Range	International flight of 8 hr or more that requires crew complement.
17	Crew Complement	Adding flight attendants to a minimum operating crew to service passengers on public aircraft transportation.



Table 3. Number and percentage of regulations and CBA using duty time and rest rules

Duty Time and Rest Rules (n=35)	Regulations	%	CBA	%
Rules Associated with Working Hour Limits (n=17) (49%)				
Maximum Flight Duty Period (FDP) in 24 hr	36	95	13	100
Maximum Duty Period in 7 days	10	26	3	23
Maximum Duty Period in 14 days	7	18	1	8
Maximum Duty Period in 30 or 28 days	14	37	5	38
Maximum Duty Period in 365 days	4	10	0	0
FDP can be 1 hr greater for Flight Attendants	8	21	0	0
Long Range Maximum	23	60	7	54
Maximum FDP Crew Complement 1	11	29	3	23
Maximum FDP Crew Complement 2	10	26	3	23
Maximum FDP Crew Complement 3	7	18	3	23
Maximum Hrs of Standby/Reserve Duty	13	34	4	31
Maximum Hrs Positioning/Deadheading	3	8	8	61
Maximum FTL in 7 days	9	24	2	15
Maximum FTLP in 2 weeks	2	5	0	0
Maximum FTL in 30 or 28 days	20	53	4	31
Maximum FTL in 1 quarter	3	8	0	0
Maximum FTL in 365 days	18	47	1	8
Rules Associated with Sleep and Rest Requirement (n=13) (37%)				
Minimum Rest in 24 hr	35	92	13	100
Minimum Rest as Long as Preceding Rest	16	42	0	0
Reduced Rest Period	16	42	10	77
Compensatory Rest	6	16	4	31
Crew Rest Facilities	21	55	4	31
On Duty Rest Break	14	37	6	46
Duration of Prone Rest (Sleep)	8	21	1	8
Additional Time for Meals or Travel	10	26	0	0
Rest during Standby/Reserve Duty	11	29	1	8
Days Off Within 7 days	22	58	10	77
Days off Within 28 to 30 days	15	39	5	38
Days off Within 1 quarter	1	3	0	0
Days off Within 365 days	4	10	0	0
Rules Associated with Circadian Rhythm (n=2) (6%)				
Late Finished or Early Starts	20	53	9	69
Time Zone Readjustment	18	47	1	8
Other (n=3) (8%)				
Commander's Discretion	17	45	2	15
Records Kept on Working Limits and Rest	20	53	0	0
Fatigue Responsibility	27	71	8	61

Table 4. Number of duty time and rest rules per regulations and CBA by member state or operator

Documents (n=51)	Working Hour Limitations	Sleep/Rest Requirements	Circadian Rhythm	Other
<b>Regulations</b>				
United States	5	5	0	1
Barbados	9	9	2	3
Bosnia & Herzegovina	11	8	1	3
Brazil	10	6	1	1
Bulgaria	9	8	2	2
Cape Verde	8	4	0	2
Cayman	3	2	2	2
China	7	2	1	1
Colombia	3	3	1	0
Czech	3	3	0	0
Denmark	3	5	1	0
Egypt	6	8	2	3
Dubai U.A.E.	6	5	2	3
European Union	5	7	2	3
Fiji	3	6	1	3
Finland	3	3	1	0
Germany	1	4	1	0
Hong Kong	5	8	2	2
India	8	4	1	2
Indonesia	5	6	0	0
Jamaica	6	6	2	3
Jordan	5	3	0	1
Kenya	3	5	2	3
Republic of Korea	1	0	0	1
Malaysia	4	7	1	3
Maldives	3	1	0	1
Malta	3	5	1	0
Nigeria	1	2	0	1
Pakistan	8	4	1	2
Philippines	7	4	0	2
Singapore	5	7	0	2
South Africa	4	0	0	1
Sri Lanka	7	6	0	3
Sudan	1	0	1	2
Tanzania	5	2	2	2
Trinidad & Tobago	8	9	2	2
Uganda	3	5	1	2
United Kingdom	8	8	2	2

Table 4. (continued)

Documents (n=51)	Working Hour Limitations	Sleep/Rest Requirements	Circadian Rhythm	Other
<b>CBA's</b>				
U.S. - American Airlines	2	4	1	0
U.S. - Delta	5	4	0	1
U.S. - Frontier	4	4	1	1
U.S. - Lynx	2	5	0	1
U.S. - Northwest Airlines	8	4	1	1
Australia - Qantas Airways Ltd	4	7	0	0
Australia - Jet Star	3	4	1	0
Canada - Air Transat	3	5	1	0
Canada - First Air Canada	3	2	0	0
New Zealand - Air New Zealand	6	6	2	0
New Zealand - Freedom Air Ltd	8	4	1	1
New Zealand - Pacific Airline	5	2	1	0
New Zealand - Jetconnect	4	3	1	2

CBA's. Barbados and Trinidad & Tobago regulations provided the most rules (n=9) associated with sleep and rest requirements, while Qantas Airway Ltd. (n=7) represented the majority of the CBA's. It is important to note that a larger number of duty time and rest rules does not necessarily equate to a superior fatigue risk management. For example, if a CAA has the most rules related to duty time and rest but the rules are outdated and not scientifically based, their effectiveness to manage risk associated with fatigue is likely inadequate.

We anticipated that the number of rules representing circadian rhythms would be lower than other categories because it is difficult for prescriptive rules to account for physiological functions (i.e., time zone transitions, layover and recovery, time of day, and circadian rhythms).

#### *Working Hour Limits*

*Flight and Duty Period (FDP).* ICAO Regulation, Annex 6, Part I requires its members to establish aircrew flight and duty time limitation and rest requirement scheduling practices that minimize fatigue. As flight attendants carry out their duties both on and off the aircraft, their workload varies; and it has been reported that underload and overload conditions are potential causes of fatigue (Hancock & Verwey, 1997). The combination of workload and flight and duty period (FDP) has the potential to magnify the effects of fatigue significantly; therefore, prescribing a proper balance between workload and the number of working hours scheduled is critical to prevent fatigue.

Table 5. Percentage of regulations and CBA using number of FDP hr

FDP Hour Limitation Within 24 hr	% Regulations	% CBA's
8	5	0
10	3	0
11	5	8
12	8	15
13	17	0
14	41	70
15	12	0
16	8	0
17	0	8

Most of the regulations (95%) and agreements (100%) used FDP to manage fatigue and 41% of those regulations and 70% of CBA's used a 14-hr daily limitation most often. Table 5 shows the percentage of regulations and CBA's using the number of FDP hr. No justification was offered to validate a 14-hr FDP limitation. The NTSB safety recommendations issued in recent years regarding fatigue included the guidance that flight and duty time limitations and rest requirements should be based on science and standardized across current diverse operations. Additionally, scientific and medical evaluators of the EU OPS flight time limitation rules Subpart Q, (Moebus, 2008) was critical of a 13-hr FDP. Moebus warned that a single FDP should never exceed 13 hr, except under specific conditions and suggested that FDP periods greater than 13 hr were inconsistent with current fatigue research. Goode (2003) warned that for pilots, the risk of having an accident was 5.5 times higher when the

FDP is 13 hr or more. “There is a discernible pattern of increased probability of an accident the greater the hours of duty time for pilots.” (Goode, 2003, p.311). The probability of fatigue also increases as more sectors are flown, as reported by Powell, Spencer, Holland, et al., (2007). Although these studies were pilot specific, they are consistent with and relevant to flight attendant duties, since many airlines have opted to apply pilot flight time limitation (FTL) rules to their flight attendants.

*Flight Time.* Many airlines have opted to apply FTL rules to flight attendant schedules. The majority of the regulations (53%) and CBA (31%) with a FTL rule restricted the hr of work within a month (28 or 30 consecutive days). However, there was significant variability (85 – 210 hr) per month that a flight attendant could work, depending on the CAA or operator. This variability suggests: (1) Lack of international standardization; (2) Outdated regulations that have not incorporated current scientific principles and knowledge on human fatigue; (3) Different flight operations require more or less hours per month (i.e., night time, long-haul, short-haul, and international operations). Research results are clear in describing the differences in fatigue associated with these diverse operations (Co, Gregory, Johnson, Rosekind, 1999; Nagda & Koontz, 2003; Rosekind, Neri, Miller, et al., 1997; Rosekind, Miller, Gregory, & Dinges, 2000).

Most of the CBAs (75%) and 45% of the regulations with an FTL rule used a 100-hr limitation within a 28 or 30 consecutive day period. This is effective if the 100 hr are spread out evenly within the month, instead of all occurring during a portion of the month (e.g., a flight attendant completing 100 hr in the last two weeks of the month). Some regulators specified that scheduled flight hours had to occur evenly during any 28/30 consecutive day time period which guards against accumulating and working many hours within a short time frame.

*Long Range and Crew Complement.* Most regulations were ambiguous regarding whether or not they addressed short- and long-range operations. For example, in a section of one country’s regulation, the rule stated the operator shall not assign a cabin crewmember an FDP to exceed 14 consecutive hr within 24 consecutive hr. However, in another section of the same regulation, the FDP was 16 hr or more, provided they added cabin crew members to the original crew complement. We made an assumption that, if the regulation had a provision for crew complement, then it had “long-range” or “long-haul” operations. Also, the organization of some regulations were ambiguous in differentiating between the duty time and rest rules applied at home base vs. during a layover.

The long-range rule used in 63% of the regulations and 54% of the CBAs had an average 18-hr FDP per 24 consecutive hr. The United Arab Emirates had a provision

in the regulation that an operator shall have an established FRMS in place for ultra long-range operations.

*FDP One Hr Greater for Flight Attendants.* Length of duty is one of several factors that contribute to flight attendant fatigue (Nesthus et al., 2007). Pilots and flight attendants working the same flight may not have the same reporting time because some operators schedule their flight attendants to report one hr earlier than pilots to accommodate for pre-flight preparations and a briefing. None of the CBAs had a rule for cabin crewmembers to report one hr before the flight crew, while 22% of the regulations had this provision. One recommendation is for airlines to develop more efficient briefing strategies to allow the cabin crew to have the same FDP as the flight crew because the level of fatigue for flight attendants maybe greater, since they normally exert more physical activity than flight crews (Moebus, 2008). Additionally, an FDP longer than 13 hr is contrary to some scientific evidence (Goode, 2003).

*Standby Rules.* Standby duty may be counted as full or half working time, depending on whether the flight attendant is in the airport, at home, or in a hotel. However, fatigue normally increases over a period of time during wakefulness, whether an individual is performing tasks with higher than normal workload or idle (Åkerstedt, Folkard, & Portin, 2004; Hancock & Verwey, 1997). Some regulators provide limitations on the maximum hours for standby and also require that the accommodations provided by the operator during standby will be suitable to allow rest. The maximum period a flight attendant was allowed to spend on standby for the regulations (34%) and CBAs (31%) was approximately 12 hr, but 66% of the regulations and 69% of the CBAs had no maximum allowable standby period provision. Only 29% of the regulations and 7% of the CBAs provided guidance on the rest period associated with standby duty.

*Positioning.* Depending upon whether positioning precedes or follows an FDP and rest period, at least half, or in some cases all, of the time required for positioning is counted toward the cumulative total duty hours. Although a flight attendant might have a sleep opportunity during positioning, the duration and quality of that sleep is expected to be significantly reduced. The average maximum time for positioning for the CBAs (18-hr) was greater than the regulations (13-hr) and 7% of the regulations and 61% of the CBAs had a provision for extending the maximum time allowed for positioning.

#### *Sleep and Rest Requirements*

*Minimum Rest.* The duration and timing of the rest period are critical factors in fatigue management. The National Sleep Foundation recommends that adults get 7-9 hr of sleep during the night. When an adult

chronically gets less than 7-9 hr of sleep, impaired brain function and cognitive performance deficits are likely to occur and increases risk (Van Dongen, Maislin, Mullington, & Dinges, 2003). Cumulative fatigue becomes problematic when minimum rest is reduced and occurs repeatedly across a three- to four-day trip.

Most of the regulations (92%) and all of the CBAs mandated a minimum rest period ranging from 8-16 hr, with the regulations averaging approximately 11 hr and the CBAs 10 hr. Type of operations and lack of an international standardization may explain the variable range in minimum rest hr. The U.S. was among the 17% of regulations with a lower than the average minimum rest period (9 hr), however; if the operator provided transportation (not local), travel time was not included as part of the rest period. India had the longest minimum rest period of 16 hr while Nigeria had the least at 8 hr. Barbados, Trinidad, and Tobago regulations excluded travel time to and from the rest facility and also allowed time for hotel check-in and check-out, personal hygiene, and meals to permit 8 hr of sleep in suitable accommodations.

Johnson (2009) recommends a procedure to “count sleep” to ensure that we are getting 7-9 hr of sleep. People typically overestimate the amount of sleep they get by *not* considering the time necessary to prepare for sleep, get ready for work, and all of the activities that normally occur in between. Table 6 demonstrates the “counting sleep” concept and how difficult it might be for a flight attendant to get 7-9 hr of sleep after working a 14-hr FDP with a 10-hr minimum rest period. Accounting for the time it takes to prepare meals, interact with other family members, and other normal adult responsibilities, it would be impractical to expect a flight attendant to function optimally and maintain a high quality of life with only a 9-hr rest period for an extended period of time at home. Table 7 demonstrates how a flight attendant would dramatically modify his/her normal lifestyle to obtain 7-9 hr of sleep.

Additionally, it is important to note that rest periods should be protected from interruptions such as calls from the airline for various routine reasons. Some regulations have a clause that doubles the rest period if the

**Table 6. Time calculated for routine activities following a 14-hr FDP getting less than 8 hr. of sleep**

Hr	Min	Activity
	30	Wake-up, groom and dress
1		Wake-up children and help get them ready
	30	Make and eat breakfast
	30	Commute to work – drop kids at school/daycare on the way
14		FDP
	30	Commute home – pick-up kids on the way home
1		Family activities or household responsibilities
1		Prepare dinner
1		Clean kitchen, check homework assignments, put kids to bed
1		Unwind, watch TV, read, pay bills, etc
	30	Prepare for bed-time; brush teeth, hair, wash face, shower, etc.
21	30	Total hr of activities
2	30	Number of hr left for sleep

**Table 7. Time calculated per activity following a 14-hr FDP with dramatic adjustments to allow for 8 hr of sleep**

Hr	Min	Activity
	30	Wake-up, groom and dress, grab breakfast on the go
	30	Commute to work
14		FDP
	30	Commute home; get fast food at drive-through and eat in car
	30	Prepare for bedtime; brush teeth, wash face, shower, etc.
16	0	Total hr of activities
8	0	Number of hr left for sleep

airline interrupts the sleep period. However, Bulgaria allows a limited amount of interrupted rest and interruption of night rest is admissible for not more than 3 consecutive nights.

*Reduced Rest.* Almost half (45%) of the regulations and 77% of the CBAs had the provision to reduce the minimum rest period when unforeseen circumstances occur in the schedule. To take full advantage of the sleep period during a reduced rest period, the scientific community recommends that the regulator should schedule the reduced rest period to occur during the entire window of circadian low (WOCL) period to maximize quality sleep (Akerstedt, 2003). Uganda defines a sufficient rest period if it includes a period of 8 hr falling between 2200 and 0800 hr local times; however, it had the lowest reduced rest period (6 hr). Of the regulations and CBAs with reduced rest period, 59% and 50%, respectively, had an 8-hr limitation. To compensate for the reduced rest period, 16% of the regulations and 31% of the CBAs had a provision for compensatory rest, extending the minimum required rest period following the next duty period.

*Days Off.* It is important that operators give crew members the opportunity to plan quality sleep by notifying them well in advance of their days off; likewise, it is important for crewmembers to effectively use their days off. Additionally, operators employing flight attendants working part-time and who have other employment should ensure they have the same opportunity for adequate rest. The United Arab Emirates has provisions for crew members who have other employment.

Over half (58%) of the regulations and 77% of the agreements required flight attendants have at least 1 day off during 7 days (See Table 8). While this may be adequate rest during daytime operations (depending on the FDP), 1 day off after working 6 days of nighttime operations would not give crew members the multiple periods of sleep during the entire WOCL period to combat cumulative fatigue. Bosnia & Herzegovina, Jet Star, and Qantas Airways Ltd. required flight attendants have 2 days off during 7 days.

*Crew Rest Facilities.* The sleeping quarters used by crew members during long-range operations and lay-

over are critical to obtaining quality sleep. Some of the regulators specified that the operator will provide adequate or suitable crew rest facilities, but they did not define “adequate” or “suitable” to establish an acceptable standard. Two regulators provided good examples of detailed descriptions of crew rest facilities. The United Arab Emirates (e.g., the rest environment should have a comfortable bunk, separated and screened from the flight deck and passengers, equipped with the ability to control humidity, temperature, lighting, and noise) and the U.S. Advisory Circular 121-31, Flightcrew Sleeping Quarters and Rest Facilities. Although AC 121-31 offers a detailed description to reduce sleepiness and improve flight crewmember performance, it applies indirectly to flight attendants. Over half (55%) of the regulations and 31% of the CBAs provided a basic description of rest facilities on or off the aircraft.

*On-Duty Rest Break.* On-duty rest breaks usually apply to long-range operations with aircraft designed to accommodate sleeping crew members. Almost half of the CBAs (46%) and 37% of the regulations had a duty rest break provision in which the operator will provide crewmembers uninterrupted rest (usually around 4 consecutive hr) in suitable in-flight accommodations.

*Duration of Prone Rest (Sleep).* Generally, the rest period referred to in the regulations includes the time it takes for travel, meals, and personal hygiene. A “prone rest” rule separates actual sleep time from other activities during the rest period and allows flight attendants “behind-the-door” or “prone” rest protection. Only 21% of the regulations and 7% of the CBAs had a protective provision requiring operators to give crewmembers prone rest.

*Additional Time for Meals or Travel.* Some regulations specifically noted that the operator should consider the time it takes to travel to and from the rest facility, hotel check-in and check-out, personal hygiene, and meals when computing minimum rest. For example, the FAA issued an interpretation emphasizing that transportation considered “local in nature” means that transportation to the rest facility should not be so time-consuming that crewmembers are unable to obtain sufficient sleep. One of the most recommended changes U.S. flight attendants

Table 8. Number and % of regulations and CBA with average days off per duty period

Duty Period Days	Regulations			Collective Bargaining Agreements		
	Average Days Off	N	%	Average Days Off	N	%
7	1	22	58	1	10	77
28 or 30	7	15	39	9	5	38
90	10	1	3	0	0	0
365	96	4	10	0	0	0

suggested in the National Duty, Rest, and Fatigue Survey was to start the scheduled rest period after arrival at the rest facility (Avers, King, Nesthus, et al., 2009 under review). On average, U.S. flight attendants wait 16 minutes for transportation, with a total of 49 minutes spent on travel to the rest facility. This leaves less than 8 hr for check-in, meals, personal hygiene, and sleep when given a minimum rest period of 9 hr (Avers et al., 2009, under review). Over one quarter (26%) of the regulations and 7% of the agreements had a provision for the operator to allow additional time for rest.

### *Circadian Rhythms*

*Late Finishes and Early Starts.* Circadian rhythms are linked to environmental cues of daylight and darkness. Night duty brings increased fatigue and when flight attendants work during the WOCL (periods from 2200 to 0459), they are especially susceptible to severe fatigue (Samel, Wegmann, & Vejvoda et al., 1997; Spencer & Robertson, 1999). Some regulations had a provision to limit the FDP during the circadian low or they avoided scheduling crews for duty during this time. For example, Hong Kong's CAD 371 cautioned schedulers to avoid the circadian low period when making crew rosters, and Trinidad and Tobago stipulated that crew members' rest should not be interrupted between 2200 and 0600 local time. The regulations (53%) and CBAs (69%) indicated some provision for late finishes or early starts.

*Time Zone Readjustment.* An international jet aircraft can cross 6 time zones between the U.S. and Europe in 7 hr; however, the rate at which humans can adjust is at minimum, 1 time zone change per day (Caldwell & Caldwell, 2003). A provision for increasing the minimum rest period due to time zone readjustment appeared in less than half (47%) of the regulations and 7% of the

CBAs. Malta included a time zone table that was easy to understand when explaining how the minimum rest will be increased (see Table 9).

### *Other Factors*

*Fatigue Responsibility.* During the investigation of the Buffalo, New York (Feb. 12, 2009) accident in which 50 people died, NTSB officials discovered that the captain and first officer commuted from different regions of the country to perform their jobs prior to the accident. The airline commented that it was a pilot's responsibility to commute to work and be fit for duty. Operators are aware that they can not control a person's personal life and, although they may give their employees rest periods, this does not guarantee that they will take full advantage of the time to get the necessary sleep to recover from fatigue. More than 70% of the regulations indicated that a crewmember, the operator, or both were responsible for managing fatigue.

*Commander's Discretion.* The pilot-in-command (PIC) may exceed the FDP or reduce the minimum rest period due to certain unforeseen circumstances (weather, air traffic control, maintenance, etc.). In 48% of the regulations and 15% of the CBAs, the "commander's discretion" applied. To guard against fatigue self-assessment errors, the Fiji Islands had a provision for the PIC to gain the concurrence of other crewmembers before extended the FDP. Barbados limited how long the PIC could reduce the minimum rest period but gave the PIC the discretion to increase the minimum rest period due to delays in travel to and from the rest facility, hotel check-in and check-out, and meals.

*Fatigue Records Kept.* Keeping organizational and individual records of actual duty and rest periods is helpful when looking back at actual duty and rest times. This procedure can help prevent illegal operations and provides insight into past schedules or circumstances that

Table 9. Example of Malta's time zone minimum rest table

<b>Malta Example</b>	
When the location of rest is 3 time zones or more from where the FDP commenced, minimum rest following a FDP shall be increased as follows:	
<u>Time Zone Difference</u>	<u>Minimum Rest Increased By</u>
0 – 2 time zones	NIL
3 – 5 time zones	1 hr
6 – 7 time zones	2 hr
8 time zones or more	3 hr

produced or elevated fatigue risk factors. Over half (52%) of the regulations had a provision that the operator or the individual should keep duty and rest period records for a specific amount of time.

*FRMS.* Several CAA representatives advised us that they were developing provisions for a FRMS, including Transport Canada, the European Union, and New Zealand. Additionally, ICAO is currently requiring operators to use a FRMS in conjunction with or as an alternative to scientifically-based, prescriptive fatigue rules. Also, any deviation from the member states' prescriptive limitations on flight time, duty periods, flight duty periods and rest periods by the operator should mandate an FRMS.

*Transport Canada.* Canadian aviation regulations (CARs) have duty time and rest rules for flight crew members (pilots), but flight attendant flight and duty time and rest requirements are currently governed by the Canada Labor Code and by CBAs with the individual employers, where they exist. Transport Canada proposed duty time and rest regulations for their flight attendants through formal consultations with all stakeholders, which began in February 2004; however, a final proposed amendment to the CARs has yet to be introduced. During the initial consultation process, it was determined that further research and consultation was necessary, with an objective to coordinate any regulatory initiatives in relation to this issue with other areas of the aviation industry, particularly aviation maintenance personnel who also lack duty-time limitations under the CARs. Transport Canada is taking preliminary steps to require by a rule that operators must implement a fatigue management system. In light of more recent considerations towards operators implementing a fatigue management program as part of their broader Safety Management System (SMS), the initial regulatory proposals have been temporarily suspended so that work can progress to harmonize with the concept of fatigue risk management and to take into account the efforts and recommendations of the ICAO (C. Dann, personal communication, Oct. 16, 2008).

*European Union.* The European Aviation Safety Agency (EASA) and The Joint Aviation Authorities (JAA) temporarily transferred their FTL operations responsibilities to European Union Operations (EU OPS) 1899/2006 governing 27 countries (Z. Savina, personal communication, Jan. 9, 2008). On January 30, 2009, EASA proposed changes affecting cabin crew training, medical fitness, and FTL and also proposed adding a FRMS as the next step after the update of the prescriptive flight time, FDP, and rest period requirements. They issued certification specifications, taking into account the latest scientific and technical evidence, and they standardized flight-time limitation schemes to provide for uniformity and fair competition in the aviation market. However, member

states may deviate from the agency's FTL requirements, subject to review and approval. For example, in April 2005, easyJet, a large European low cost carrier became the first major airline to be granted alleviation from the FTL prescriptive rules based on the results of a safety case report during a 6- month roster trial.

Some of the European Union member states (i.e., Germany, Czechoslovakia, Finland, and Denmark) are included in this analysis, in addition to the main EU OPS regulation, because they have written a supplement that imposes stricter rules than the governing authority.

*New Zealand.* The New Zealand CAA indicated that there are no prescriptive rules governing flight attendant fatigue, but the operators are responsible for monitoring their work load, which could be done through a fatigue management program. The CAA is taking preliminary steps to require by a rule (initial draft of rule proposal expected in September 2009) that operators must have established a fatigue management system. This requirement is limited to agricultural operations and work on it has begun (E. Randall, personal communication, September 9, 2008).

## DISCUSSION

The examination of international policies and regulations has revealed 2 overarching types of regulatory practices: common practices and best practices. Common practices manage fatigue risk almost solely through prescriptive limits on the maximum duration of work periods and minimum duration of rest periods. Best practices manage fatigue incorporating science-based knowledge regarding time zone transitions, layover and recovery, time of day, and circadian rhythms (i.e., physiological functions, such as body temperature, hormone secretion, sleepiness, wakefulness, and alertness variations within a cycle of approximately 24 hr).

### *Common Practices*

The results indicate that internationally, common practices are based on prescriptive rules that specify duty time and rest limitations within a period of time. Globally, each operator schedules flight attendants based on prescriptive rules, while bracing for likely disruptions that increase the costs of airline operations. "Domestic flight delays last year cost the U.S. economy as much as \$41 billion and raised airlines' operating costs by \$19 billion" (Fleming, 2008, p.1).

Due to recent cost increases, operators appear to be scheduling to the prescriptive limits more frequently. An FAA cabin safety ASI explained, "Now as a result of the economics, airlines are now scheduling down to the rule. When [airline] changed from the agreed labor contract



down to the requirements of 121.467, in 2002, this office received over 108 national hotline complaints in a 90-day period” (T. Blower, personal communication, October 30, 2008). Some U.S. flight attendants have complained that airlines are now so focused on their “on-time performance” that they don’t leave enough time in the schedule for meal breaks, particularly when they are working domestic trips with multiple legs and quick turns (Avers, et al., 2009, under review). Ultimately, going without nourishment gradually decreases energy levels during a 12-14 hr duty day with multiple legs, which undoubtedly increases the risk of fatigue and reduces safety margins.

These reports indicate that the existing prescriptive rules are insufficient for effectively managing fatigue in round-the-clock operations. Dawson and McCulloch (2005) reported that using prescriptive rules alone is limiting and inflexible because they permit legal scheduling to extreme fatigue levels and do not take into account a schedule with night flying, early starts, late finishes, and time zone changes. Prescriptive rules also do little to address individual fatigue issues that many flight attendants endure (e.g., interrupted sleep, difficulty falling asleep, and lack of proper nutrition). Essentially, prescriptive rules manage the duty time of flight attendants but, they do not effectively account for the amount of sleep a flight attendant will receive between duty periods. Hence, they fail to optimally manage the risk of fatigue. When comparing U.S. prescriptive rules with the other nations in this study, U.S. flight attendants are required to work a longer FDP and long-range maximum hr per day and have less recovery time due to a shorter minimum rest and reduced rest period (See Fig. 1). Hence, U.S. prescriptive rules are among the least restrictive, representing a greater than typical fatigue risk.

#### Best Practices

Best practices are adaptive and manage fatigue by incorporating science-based knowledge. An FRMS is a popular solution to counterbalance the inflexibility of the prescriptive rules and shows some effectiveness within airlines currently applying this approach to fatigue mitigation. The ICAO is requiring international regulatory authorities to integrate a FRMS as part of their overall SMS, while the EU-OPS requires the implementation of a FRMS if a country has a reduced rest, extended duty, or split-time rule provision. However, it should be noted that simply modifying the prescriptive rules to allow for increased flexibility in FDP limits does not necessarily lead to improved or more

comprehensive management of fatigue (Signal, Ratieta & Gander, 2006). Only a mature FRMS program with the following should be considered:

- Data-driven.
- Adaptive.
- Recognizes fatigue risks.
- Develop and evaluate mitigation strategies.
- Manage any emerging operational risk.
- Iterative feedback and solutions.
- Identifies operational aspects that contribute to fatigue.

## RECOMMENDATIONS

We recommend establishing a flight attendant fatigue workgroup of subject matter experts, aviation stakeholders, medical and research scientists, and aviation SMS experts to evaluate 14 CFR sections 121.467 and 135.273 for possible revision and to develop an adaptive fatigue mitigation safety system, such as a FRMS, that combines the scientific principles and knowledge with operational support.

#### Limitations

This study found some variability between the number of duty time and rest rules provided in the regulations and CBAs evaluated. This may have been the result of possible misinterpretation of the ambiguities and inconsistencies in the regulations and CBAs, since some were found to be difficult to understand. Also, fewer rules were found for some European states because we only examined a partial supplement of a primary regulation.

The data reported in this study reflect a fairly comprehensive review of information provided in the form of official regulations and CBAs obtained from international sources. Some of the information reviewed (particularly

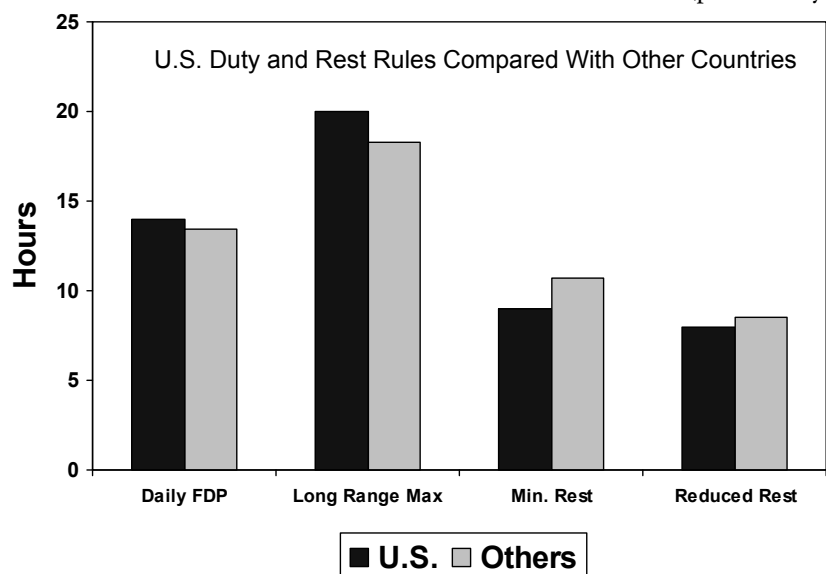


Figure 1. U.S. regulation comparison.

with regard to the CBAs) may have changed between the time the documents were collected and when this report was written. While many ICAO member states had regulations for pilot's FDP and rest requirements, guidance specifically written for flight attendants was minimal. Also, there was some variability with respect to the number of duty time and rest rules found between countries. Again, this might have been a result of our interpretation and the inherent ambiguities and inconsistencies in those regulations and CBAs.

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